A.D. 1872, 14*th* OCTOBER. N° 3028.

SPECIFICATION

OF

HENRY YOUNG DARRACOTT SCOTT.

TREATING SEWAGE.

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A.D. 1872, 14*th* OCTOBER. N° 3028.

Treating Sewage.

LETTERS PATENT to Henry Young Darracott Scott, of Ealing, in the County of Middlesex, Major-General, C. B., for the Invention of "IMPROVEMENTS IN APPARATUS FOR THE TREATMENT OF SEWAGE."

Sealed the 1st April 1873, and dated the 14th October 1872.

PROVISIONAL SPECIFICATION left by the said Henry Young Darracott Scott at the Office of the Commissioners of Patents, with his Petition, on the 14th October 1872.

I, HENRY YOUNG DARRACOTT SCOTT, of Ealing, in the County of Middlesex, Major-General, C. B., do hereby declare the nature of the said Invention for "IMPROVEMENTS IN APPARATUS FOR THE TREATMENT OF SEWAGE," to be as follows:—

The objects of this Invention are the precipitation of and the separation of the superfluous water from sewage sludge in an economical and inoffensive manner.

The first part of the Invention (having reference to the clarification of sewage only) relates to the method of supplying the lime to the sewage for the purpose of precipitation by the lime process, the main object being to economize labour, and effect the purpose by mechanical means.

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This is effected in the following manner:—In lieu of adding slacked lime or milk of lime directly to the sewage water by hand labour in the manner usually practised, I commence the operation by grinding the quicklime to a powder, and I pass this from a hopper (provided with a stirrer or other equivalent mechanical device) actuated by the flow of the water or otherwise, into a vessel, through which water is kept continually flowing with sufficient force to keep in suspension the fine particles of slacked lime, which will result from the action of the water upon the less bulky particles of the quicklime. An opening is made in the side of the vessel by which the fine particles held in suspension in the water pass off with the water to the sewer.

In carrying out the second part of my Invention I treat the sludge (after its separation from the sewage water, whether by straining, subsidence, or precipitation, as above-described, or in any other way) by a process in which stirring movement or agitating of the particles is combined with pressure and filtration. This effect may be produced by introducing the sludge into a pug mill of novel construction, having its containing walls and bottom formed of a material which will permit the filtration of water, and its axle and arms hollow, and covered like the sides with a material which will allow the water to be drawn through it by suction or forced through it by pressure. The arms are arranged to act with downward and outward pressure, and the containing walls of the pug mill are sometimes surrounded with an outward casing, so as to allow exhaustion of the contained air to take place, and the water which flows through the filtering medium to be removed. In place of the pug mill a horizontal or inclined cylinder of analogous construction may be employed, and will produce precisely the same result. On leaving the pug mill the sludge, deprived more or less of its water, is introduced into a trough or receptacle (having a perforated bottom) where the sludge can be intersected or divided by means of walls or intervening columns, and passages formed of some filtering medium such as town ashes, old mortar, burnt ballast, broken bricks, oyster shells, gas lime, or other refuse, suitable as ingredients of mortar; or bones, shoddy, tan, or other refuse suitable for manure may be used as the filtering medium. By this means the remainder of the superfluous water will be allowed to pass away from the sludge. On the top of the contents of the trough I sometimes put lime, sulphate of lime, green vitriol, or other deodorants, depending on the intended application of the dried sludge.

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The bottom of the trough may be arranged to allow exhaustion to take place beneath it, and the pressure of the atmosphere to be brought upon the sludge, so as to force the water through the filtering medium.

Sometimes also with the view of a more complete desiccation or even calcination of the contents of the trough I construct the whole of brick or iron, so as to allow of heated air being carried or forced through the flues beneath the trough and up through the porous passages formed by the town ashes or other refuse filtering medium, as above described. Into these porous passages or flues may be introduced a small quantity of coke or coal if found necessary, and arrangements may be made for collecting the ammoniacal gases which will be evolved in the process of drying or burning, and for the consumption of noxious gases by passing them through or over a furnace.

In the case of small towns in which rapidity in dealing with the sludge is of less importance, and in cases where it may be advisable to avoid expense, the pugging arrangement is omitted, on the other hand in the case of large towns the above described mode of introducing the lime will be less convenient than doing it by manual labour which better allows of a proper adjustment of the varying quantity of lime required by sewage.

From the above explanation it will be evident that under different circumstances one or other part of the Invention may be dispensed with, whereas in other cases it may be more desirable to use all parts.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said Henry Young Darracott Scott in the Great Seal Patent Office on the 12th April 1873.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, Henry Young Darracott Scott, of Ealing, in the County of Middlesex, Major-General, C.B., send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Fourteenth day of October, in the year of our Lord One thousand eight hundred and seventy-two, in the thirty-sixth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Henry Young Darracott Scott, Her special

licence that I, the said Henry Young Darracott Scott, my executors, administrators, and assigns, or such others as I, the said Henry Young Darracott Scott, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "IMPROVEMENTS IN APPARATUS FOR THE TREATMENT OF SEWAGE," upon the condition (amongst others) that I, the said Henry Young Darracott Scott, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that I, the said Henry Young Darracott Scott, do hereby declare the nature of my said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement (that is to say) :—

The objects of this Invention are the precipitation of the solid matters from sewage and the separation of the superfluous water from sewage sludge in an economical and inoffensive manner.

The first part of the Invention (having reference to the clarification of sewage only) relates to the method of and arrangement of apparatus for supplying the lime to the sewage for the purpose of precipitation by the lime process, the main object being to economize labour and effect the purpose by mechanical means, so that the process may be carried on automatically. This object is effected by means of the apparatus and mechanical arrangements hereafter described. I would here however remark that the precipitation of the solid matters from sewage has heretofore been usually effected by adding slaked lime or milk of lime directly to the sewage water. When slaked lime is employed it is liable to cake in the vessel in which it is placed, and in that state will not run freely therefrom into the sewage water. The process has therefore to be carefully watched and attended to by the workman in order to keep the lime in motion and prevent it from clogging. If however the lime be used in a dry granulated state without slaking, this inconvenience will

not arise, and no difficulty will be experienced in supplying the lime in regulated and uniform quantities by mechanical means.

In carrying out my Invention I commence the operation by grinding the quicklime to a powder, and this granulated quicklime is placed in a hopper (provided with a stirrer or other equivalent mechanical device actuated by the flow of the water or otherwise), so as to keep the granulated lime in motion. From this hopper the lime will run freely into a vessel through which water is kept continually flowing with sufficient force to keep in suspension the fine particles of slaked lime which will result from the action of the water upon the less bulky particles of the granulated quicklime. An opening is made in the side of the vessel by which the fine particles held in suspension in the water will pass off with the water either to the mass of sewage or to the sewer, and by acting on the liquid sewage will precipitate the solid matters therefrom, as is well known.

In place of running the quicklime from the hopper into the sewage I sometimes cause it to be delivered in a granulated condition into the buckets of a water wheel, which works in a channel or trough, through which the sewage passes. The buckets of this wheel are perforated so as to allow the lime as soon as it is slaked by the liquid sewage to pass out and flow into the sewer. The wheels may be turned by the sewage current or by machinery, so that there will be a continuous supply of quicklime, which will be gradually slaked and partially dissolved.

In carrying out the second part of my Invention I treat the sludge (after its separation from the sewage water, whether by straining, subsidence, or by precipitation as above described, or in any other way) by a mechanical process in which a stirring movement or agitation of the particles is combined with pressure and filtration. In order to effect this object the precipitated sludge is introduced into a pug mill of novel construction. The containing walls and bottom of this pug mill are formed by preference of perforated metal, covered or lined with a substance such as canvas, matting, or some other fibrous material, which will permit of the filtration or separation of the water from the solid matters. The axle and arms of this pug mill may if desired be made hollow and covered like the sides of the mill with a material which will allow the water to be drawn through it by suction or forced through it by pressure. The arms are arranged to act as in most pug mills with a downward and outward pressure, and the containing walls of the pug mill are some-

times surrounded with an outer casing, so as to allow exhaustion of the air contained in the annular space to take place, and thus facilitate the separation of the water, which when it passes through the filtering medium into the annular space may be easily removed.

In place of the pug mill (which is stationary, the arms and axle alone being moveable) a horizontal or inclined cylinder made with perforated sides covered or lined with canvas, matting, or some other analogous filtering medium may be employed, and if the cylinder be kept constantly in motion, either by rotating or rocking it, so as to keep the filtering medium clear of the solid matters, precisely the same result, that is, the separation of a large portion of the liquid from the solid matter will take place. On being removed from the pug mill or the filtering vessel above described the sludge (deprived more or less of its water) is introduced into a trough or receptacle (having a perforated bottom and sides). The sludge is to be intersected or divided up into sections by means of walls or intervening columns and passages formed of some filtering medium, such as town ashes, old mortar, burnt ballast, broken bricks, oyster shells, gas lime, or other refuse suitable as ingredients of mortar. These materials may if desired be held in position in the trough by means of vertical perforated partitions, or they may be placed in small heaps or banks across the trough at intervals of a few inches, the object of this arrangement of filtering apparatus being to so divide up or separate the mass of sludge that the watery particles may have every facility of escaping through the filtering surfaces with which the sludge is surrounded. Instead of the earthy substances above mentioned crushed bones, shoddy, tan, or other refuse suitable for manure may be used as the filtering medium.

I also sometimes use some of the sewage sludge partly or wholly calcined as the filtering medium, or I may use for the divisions of filtering media canvas bags filled with any suitable porous substance. In all these cases the thickness of the layers of sludge should not exceed six or eight inches. The filtering divisions may be from two to five inches through, according to the material used. By this means the remainder of the superfluous water will be allowed to pass away from the sludge. On the top of the contents of the trough I sometimes put lime, sulphate of lime, green vitriol, or other deodorants depending on the intended application of the dried sludge. The bottom of the trough may if desired be arranged to allow exhaustion to take place

beneath it, so that when the pressure of the atmosphere is brought upon the sludge it will force the water through the filtering medium, leaving the solid matters behind in a pasty state, or in the condition of thick solid mud, in which state it may be removed from the trough either alone or mixed with the granulated filtering substances according to the purpose for which it is intended to be employed.

I sometimes arrange the filtering apparatus as follows:—I employ a large trough with a perforated bottom, the perforations being from six to twelve inches apart and two or three inches in diameter. Into these perforations I fit iron or wooden tubes, which are removable. Into the tubes I pour granulated coke, coal dust, or sawdust. I then run the sludge into the trough, and afterwards draw out the iron tubes, leaving so many columns of filtering media standing in the sludge. When sufficiently consolidated to be handled the whole is dug out together. If the sludge when dried is to be converted into cement or burned the carbonaceous substances will facilitate this operation.

Sometimes with the view of a more complete desiccation or even calcination of the contents of the trough I construct the whole of brick or iron, so as to allow of heated air being carried or forced through flues beneath the trough and up through the porous passages formed by the town ashes or other refuse filtering medium as above described. Into these porous passages or flues may be introduced a small quantity of coke or coal if found necessary, and arrangements may be made for collecting the ammoniacal gases which will be evolved in the process of drying or burning the solid sludge or mud. Any noxious gases that may be evolved during the burning process may be consumed by passing them through or over a furnace.

In the case of small towns, in which rapidity in dealing with the sludge is of less importance, and also in cases where it may be advisable to avoid expense, the pug mill arrangement may be omitted. On the other hand in the case of large towns the above-described mode of introducing the lime will be less convenient than doing it by manual labor, which better allows of a proper adjustment of the varying quantity of lime required by the sewage. From the above explanation it will be evident that under different circumstances one or other part of the Invention may be dispensed with, whereas in other cases it may be more desirable to use all parts.

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Having now described my Invention, and having explained the manner of carrying the same into effect, I claim as the Invention secured to me by Letters Patent as aforesaid,—

First. The arrangement or combination of apparatus herein set forth for introducing quicklime in a granulated state into sewage water, such apparatus consisting of a hopper (in which the granulated quicklime is placed) in combination with a vessel into which the lime is delivered from the hopper in regulated quantities and in a uniform manner, and is washed out therefrom by the sewage as it slakes or is dissolved. I also claim the use of a water wheel or other equivalent device provided with perforated buckets to receive the granulated quicklime and pass it into the sewage, so that it may be gradually slaked and washed out and run into the main body of the sewage as herein set forth.

Second. I claim the apparatus above described for effecting the partial separation of the liquid from the solid matters of sewage by the combined action of filtration and the movement of the particles of the sewage either by means of stirrers or agitators or by communicating motion to the containing vessel, as and for the purpose herein set forth.

Third. I claim the combination with a perforated trough or filtering vessel of mounds, heaps, or walls of any suitable filtering substances, as and for the purposes herein set forth. I also claim the application of vertical filtering media for the purpose of extracting or separating the water from sewage deposits by lateral filtration or absorption as herein set forth.

In witness whereof, I, the said Henry Young Darracott Scott, have hereunto set my hand and seal, the Ninth day of April, in the year of our Lord One thousand eight hundred and seventy-three.

HENRY Y. D. SCOTT. (L.S.)

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